PROJECT SUMMARY

Overview:

The University of Chicago's Center for Elementary Mathematics and Science Education and the University of Illinois at Urbana-Champaign's College of Education propose a two-year STEM+C Track 1 Exploratory Integration project, "EI: Learning Trajectories for Integrating K-5 Computer Science and Mathematics," which will create prototype learning trajectories for computer science at Grades K-5. Each trajectory will span multiple grades and will include a target goal, intermediate objectives, performance expectations, sample tasks and assessments, and hypothetical learning paths. The prototype learning trajectories, including the sample tasks and assessments, will be designed to fit with Everyday Mathematics 4 (EM4), the elementary curriculum from the University of Chicago School Mathematics Project. Since EM4 is newly revised to closely align with the Common Core State Standards for Mathematics (CCSS-M), the tasks and assessments will also be usable with other instructional materials aligned with CCSS-M. The learning trajectories (LTs) will be developed and tested in collaboration with 18 teachers and 4 teacher-leaders in public schools in Champaign, Illinois.

Intellectual Merit :

This project will advance knowledge in three ways.

First, despite considerable interest and activity about computer science (CS) in the elementary school, a lack of clarity about goals and paths to those goals has hindered progress in the field. This project will synthesize a great deal of theoretical and practical work in elementary school CS and advance upon that work by applying learning-trajectory approaches that have been productive in other fields. The project will produce hypotheses about goals and learning paths for elementary school CS that can be tested in further research.

Second, the project will develop insight into the feasibility of an LT-based approach to the integration of CS with mathematics. Despite the lure of synergies that might be achieved through the integration of different school subjects, even such compatible disciplines as science and mathematics continue to be taught largely in isolation from one another. This project could provide a new model for the integration of subject matter based on coordination of LTs.

Third, the project will provide preliminary evidence about the effects of CS instruction on K-5 students' attitudes towards CS and about what K-5 teachers need to know in order to implement CS tasks and assessments in their classrooms.

Broader Impacts :

This project has the potential for broader impacts in three areas.

First, the project's LTs will be foundational for the design and development of instructional materials and assessments for CS in grades K-5. Since most K-5 teachers are generalists, they are even more dependent on such materials than teachers at higher levels. If CS is to be taught in these grades, teachers will need materials such as those this project will enable. Given the CS-related pipeline, workforce, citizenry, and individual success issues that our society faces, a strong case can be made for CS instruction in the elementary grades and for the development of materials that can support such instruction.

Second, as testable hypotheses about children's development of CS concepts, skills, and attitudes. the project's LTs will be foundational for research into how K-5 children learn CS. A more principled approach to CS research will yield findings that are more useful to teachers, developers of instructional materials, and policy makers.

Third, the project will develop an LT-based model for the integration of subject matter that may be generalizable to the integration of CS with other subjects (e.g., science) and of other subjects with each other (e.g., science and mathematics). Given the perennial struggle for time in the elementary school day, the integration of subject matter could yield significant benefits.